# Effect of wind field on rainfall value of Doppler radar

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In recent years, the use of a new generation of Doppler weather radar to invert precipitation rainfall technology has become the focus of radar data application research, and is one of the main research directions of radar technology development. Inversion of precipitation rainfall by radar can obtain large-area high-resolution precipitation information in time to improve the accuracy of rainfall forecasting. Radar inversion of precipitation is the basic data of refined meteorological services. It has high application value for monitoring and analysis of weather and climate, assessment of heavy rainfall disasters, inspection and calibration of numerical prediction models, and hydrological analysis.

Based on the previous research results, this paper proposes the surface

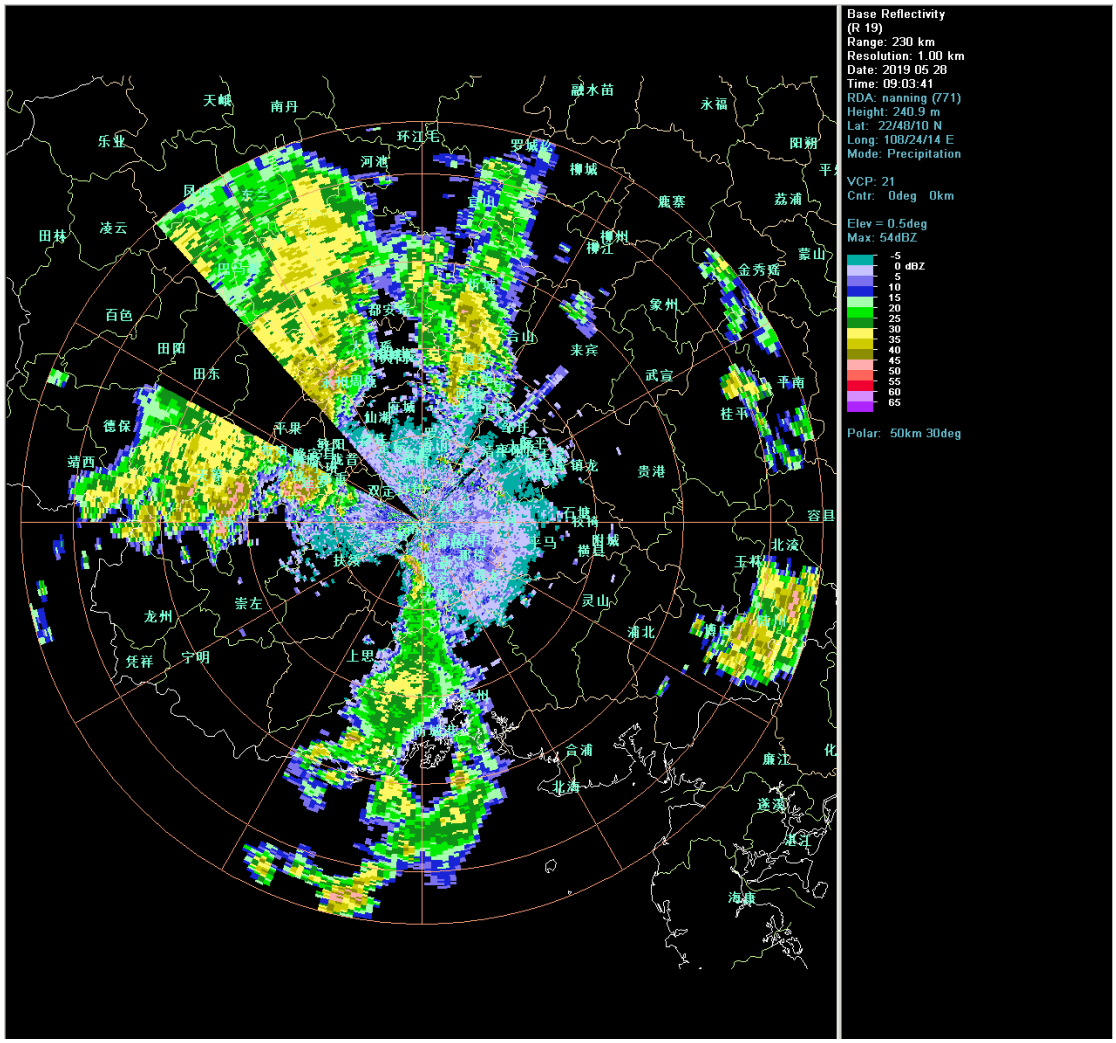
rainfall of the radar secondary product using the daily business application after the wind field influencing factors, and then the rainfall of the surface of the automatic station network in the region. Compare and explore the effect of the surface rainfall of the radar obtained by this method.

1 Technical solution for weather radar inversion of rainfall

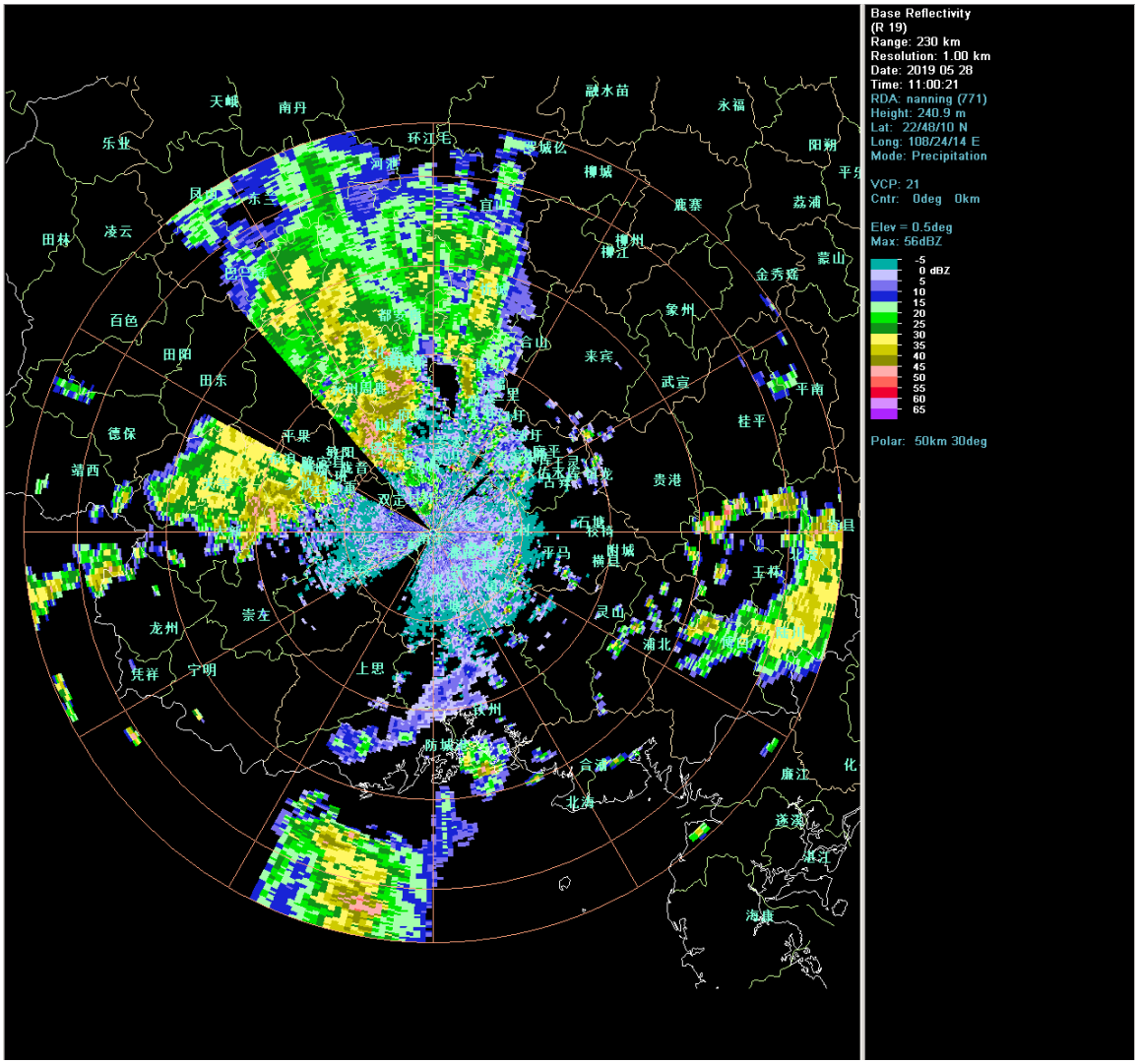
The main methods for obtaining rainfall through radar echo (reflectivity) are Z-I relationship method, standard target method, attenuation method and orthogonal polarization method. Although many measures have been taken to improve the accuracy of radar quantitative precipitation measurements, the overall accuracy of using radar to measure single-point quantitative precipitation is not high, and the overall error is generally higher than 50%. This study proposes a method to obtain the radar echo reflectance map of a certain area in a certain period of time, and superimpose these reflectance maps to obtain the total reflectivity of the time period, which will reach the ground after the influence of the wind field is added. The total reflectivity is inversed to the total surface reflectance of the surface.

Data acquisition: Select the radar echo reflectivity map obtained by the new generation Doppler weather radar in Nanning. The time period is 09-11 on May 28, 2019 (Beijing time, corresponding to World Time 01-03) for 2 hours. A reflectance map is produced every 6 minutes, so 20

reflectance maps (Fig. 1) are obtained, and these reflectance maps are superimposed by software to obtain the total reflectance in the air (Fig. 2). Dynamic video was synthesized to study the reflectance path (Figure 3).




(1)




(2)

Figure 1 Radar echo reflectivity at 09-11 on May 28 (only 2 of them are shown, others are in the attachment)

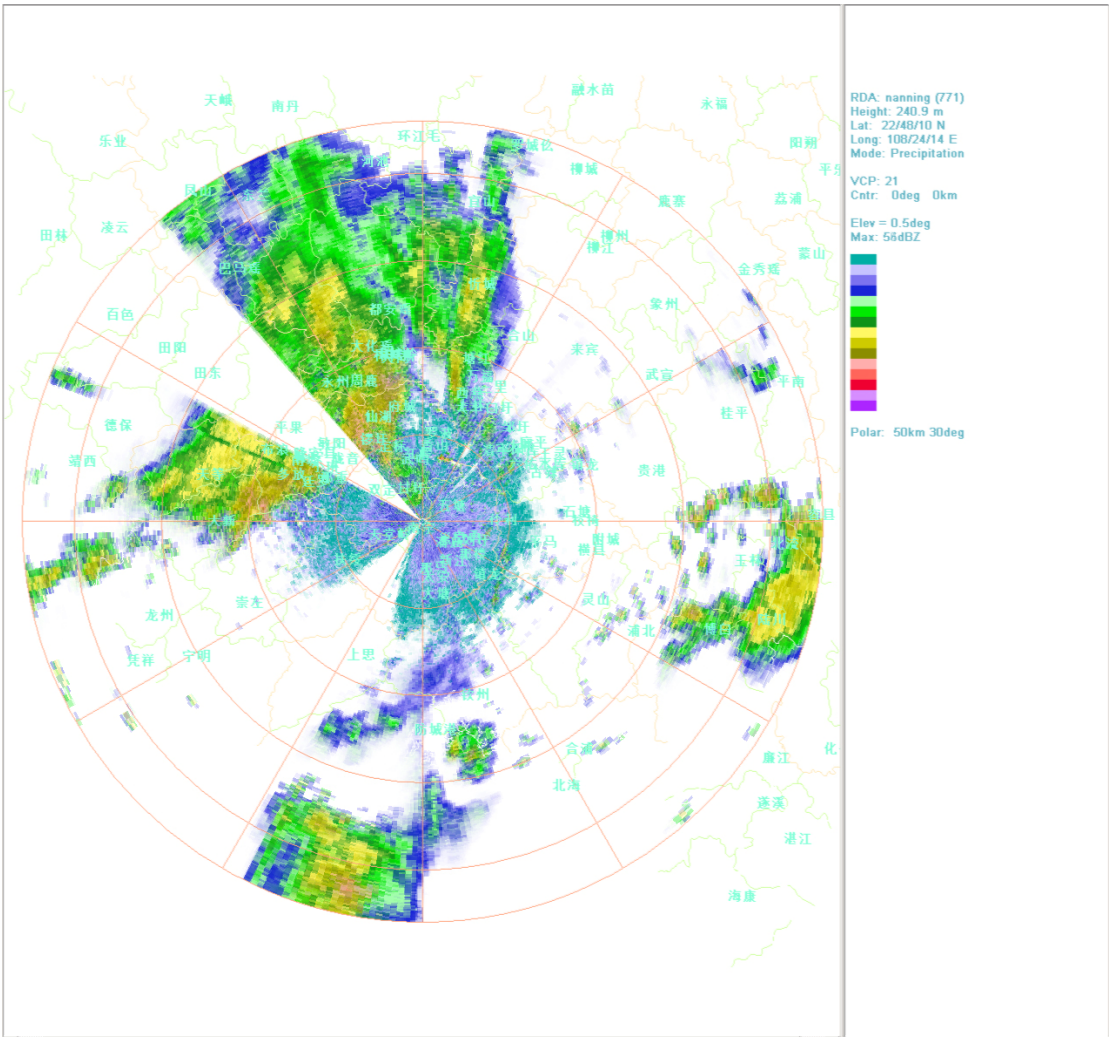



Figure 2 total reflectivity

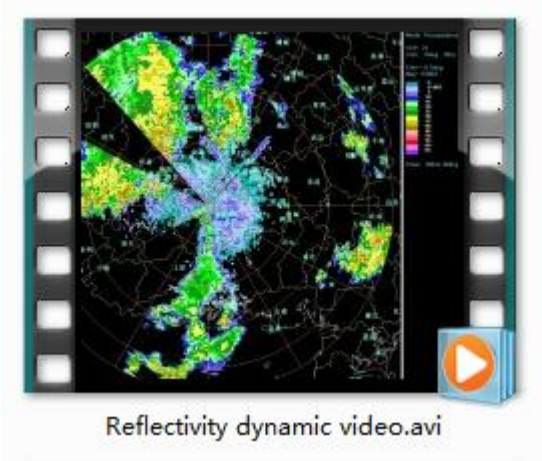
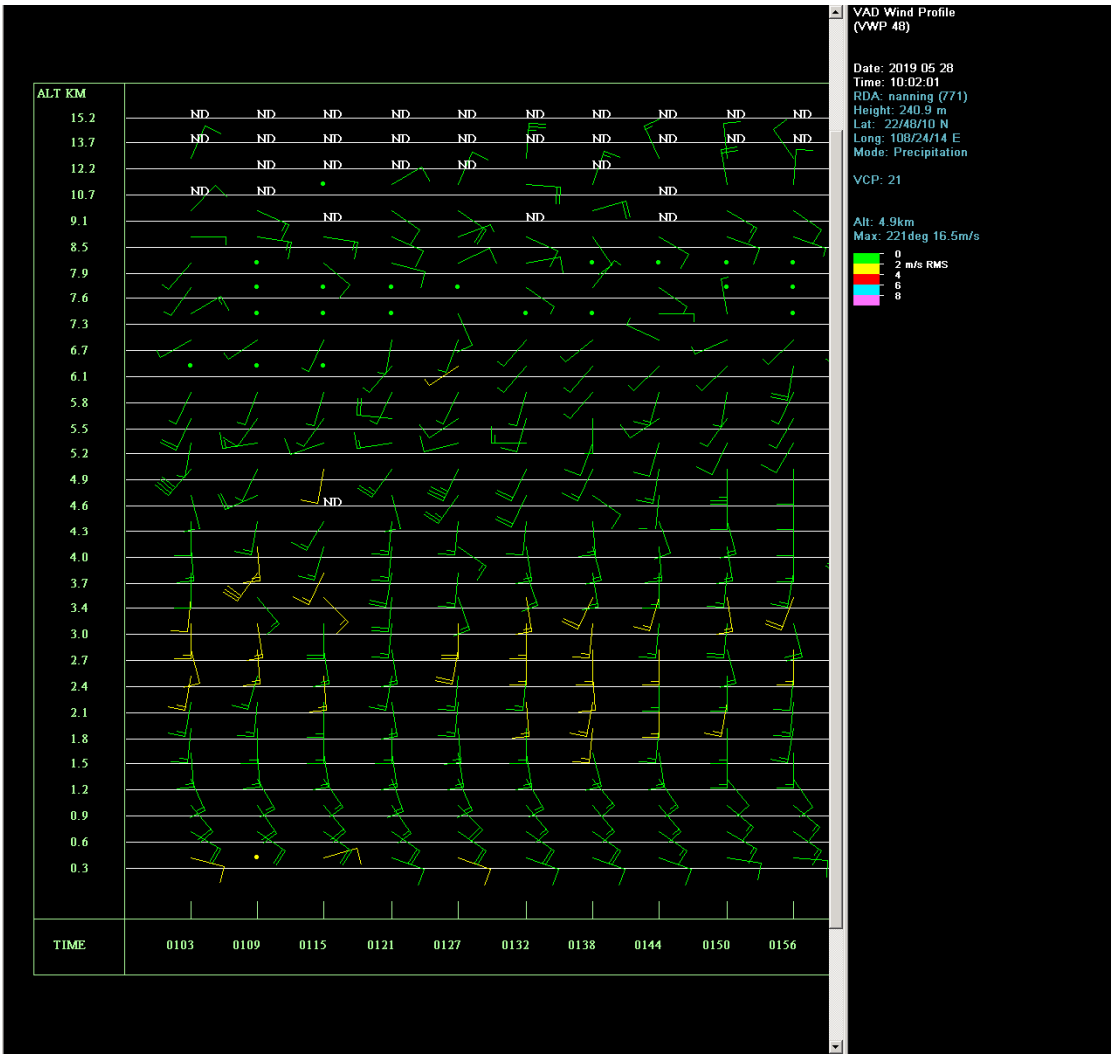



Figure 3 Reflectivity dynamic video, Please play in the attachment

2 Wind field acquisition: Wind fields play an important role in weather analysis and forecasting. The impact of wind farms on rainfall is multifaceted. The Doppler weather radar provides wind field information in the echo zone. The Nanning New Generation Doppler Weather Radar provides a velocity azimuth display (vad) from the radial wind field inversion of the average wind speed and the average wind direction. Although the vad inversion wind field has some defects that cannot be inverted in the actual wind field, because of the method comparison Simple, so this article is directly obtained in the Nanning New Generation Doppler Weather Radar (Figure 4).


VAD Wind Profile
(VWP 48)
Date: 2019 05 28
Time: 10:02:01
RDA: nanning (771)
Height: 240.9 m
Lat: 22/48/10 N
Long: 108/24/14 E
Mode: Precipitation
VCP: 21
Alt: 4.9km
Max: 221deg 16.5m/s
0
2 m/s RMS
4
6
8
ALT KM
15.2
13.7
12.2
10.7
9.1
8.5
7.9
7.6
7.3
6.7
6.1
5.8
5.5
5.2
4.9
4.6
4.3
4.0
3.7
3.4
3.0
2.7
2.4
2.1
1.8
1.5
1.2
0.9
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0103
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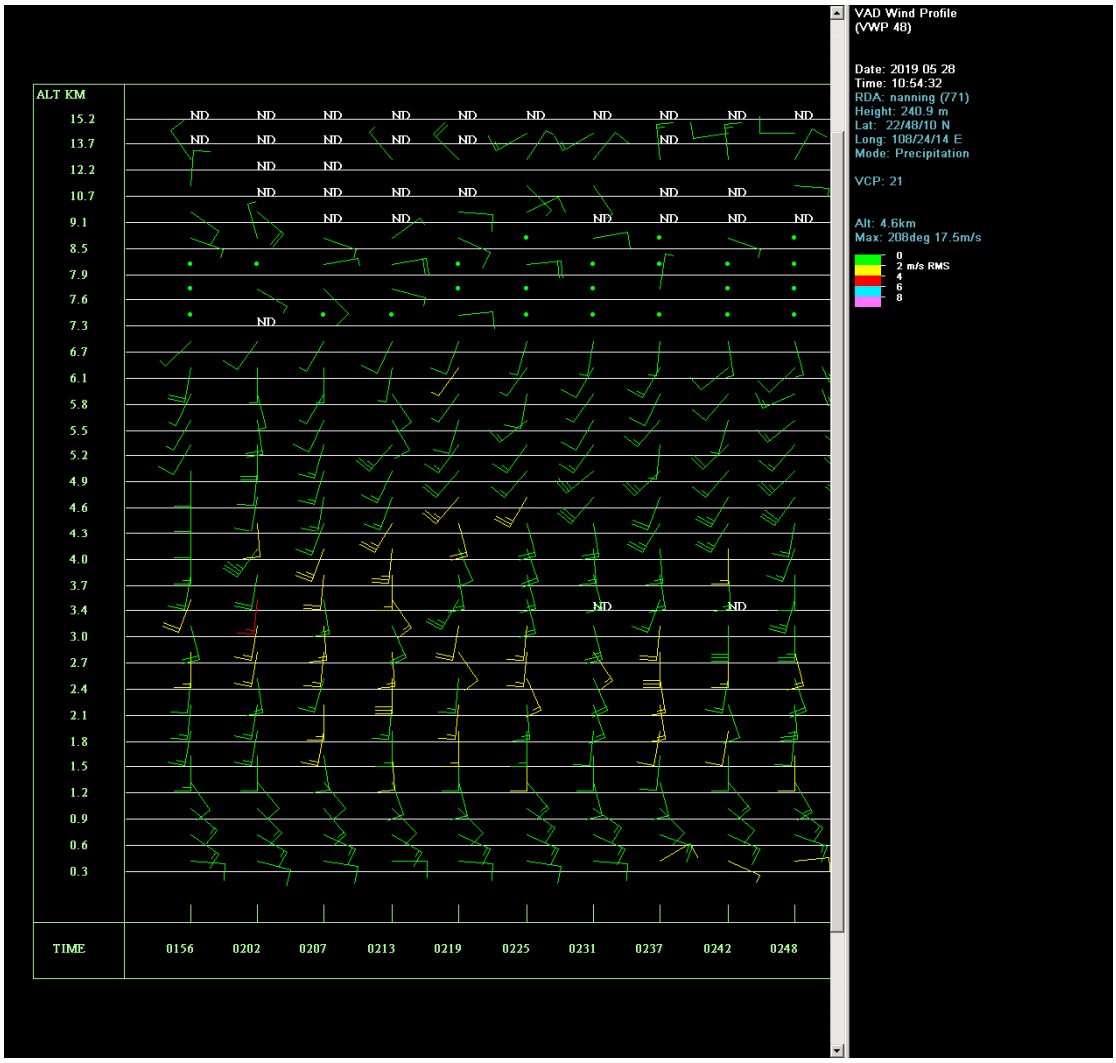
(1)




(2)

Figure 4 vad inversion of the wind farm

Adding the total reflectivity of the radar after the influence of the wind field. Ground surface rainfall: After adding the total radar reflectivity to the vad inversion wind field, the total reflectivity of the ground is obtained, and then the ground surface rainfall is inverted according to the total reflectivity (Figure 5). .

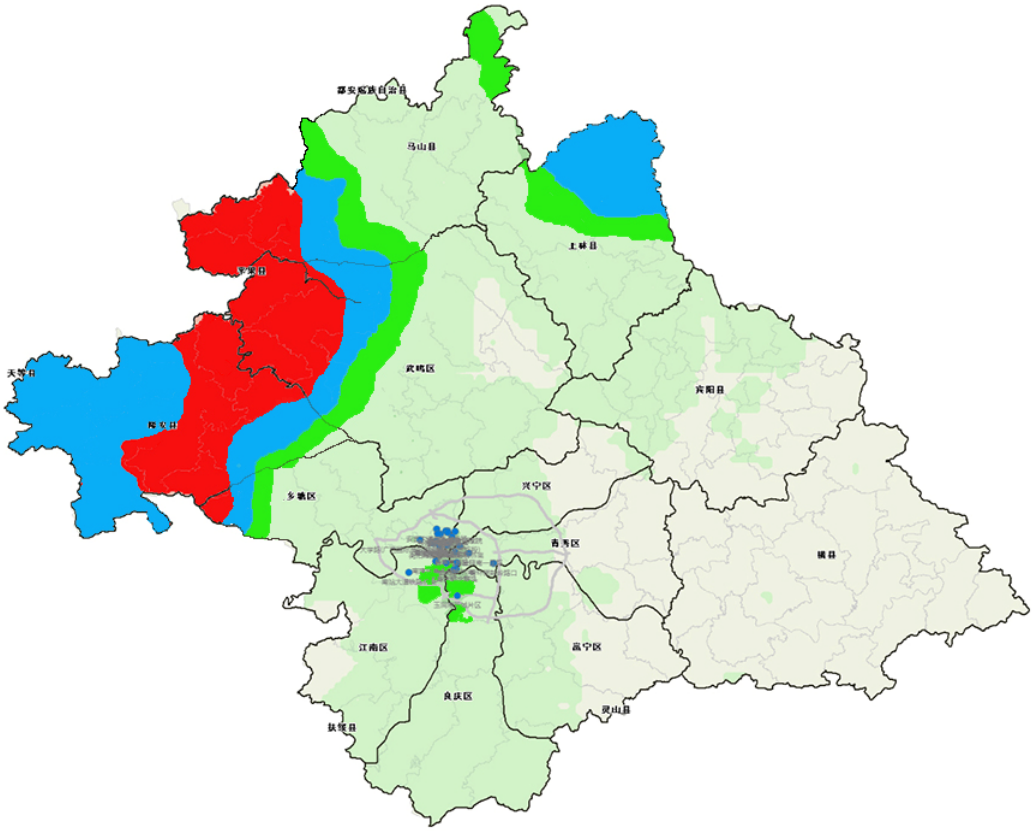



Figure 5 Total reflectivity ground surface rainfall

3 Automatic rainfall station surface rainfall

The so-called rainfall is measured by the automatic rainfall observation station located in the area, also called the amount of rainfall. The point rainfall can only represent a certain point or a smaller range of precipitation. The rainfall of each single automatic rainfall station The amount of mathematical calculations that can represent the average precipitation in the area is called surface rainfall. The information is from Nanning City. Nanning has an area of 22,112 square kilometers and has

300 automatic rainfall stations with a spacing of 10-15 kilometers. The rainfall value of each station is obtained every minute. Time and site density collect relative actual rainfall data. The statistical period is the same as the radar, and the surface rainfall during this period is obtained by the software developed by the Nanning Meteorological Bureau (Figure 6).

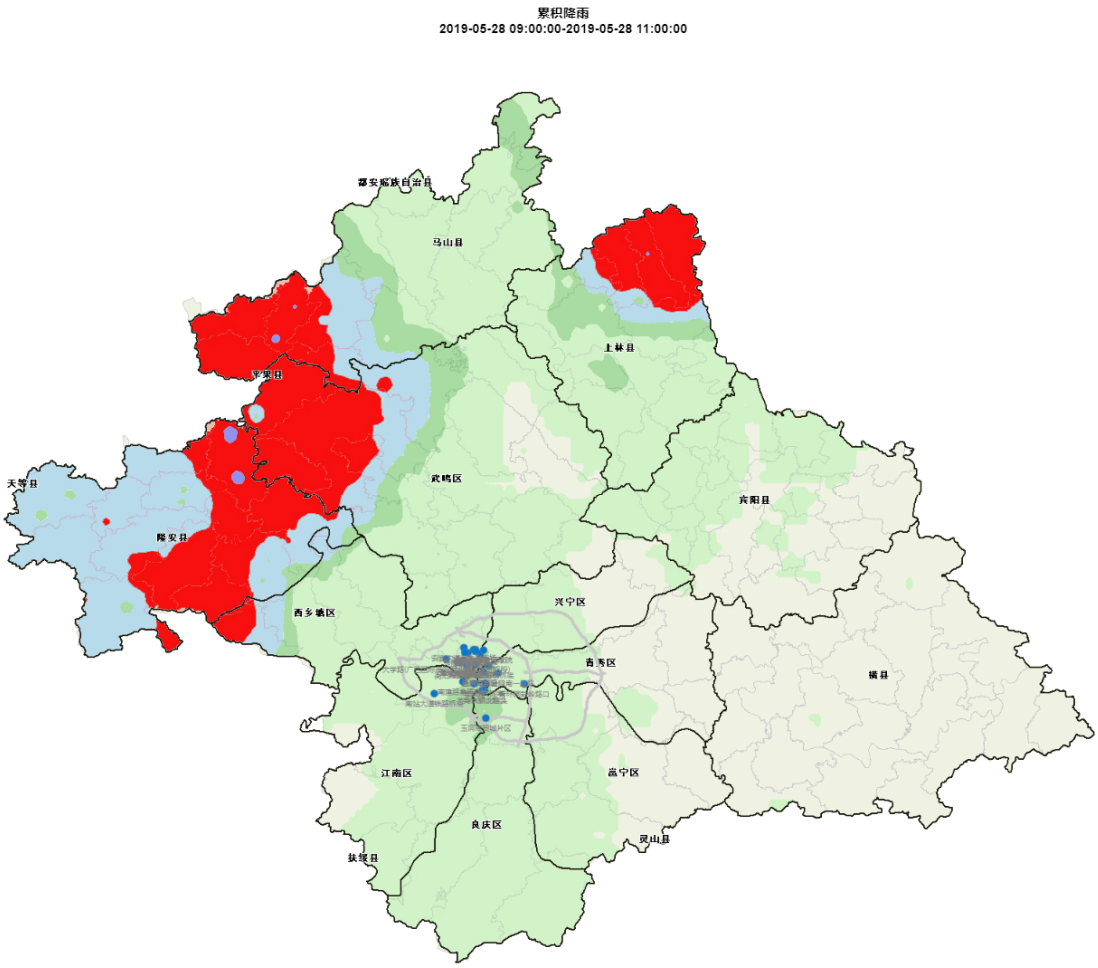



Figure 6 Rainfall of automatic rainfall station in Nanning City from 09-11 on May 28

4 Comparison of total reflectivity surface rainfall with automatic rainfall surface rainfall

In order to facilitate the comparison, the original automatic rainfall station surface rainfall (Fig. 6) was transformed into (Fig. 7). First, the automatic rainfall station surface rainfall (Fig. 7) is compared to the total reflectance (Fig. 8), and then the automatic rainfall station surface rainfall is compared with the total reflectivity surface rainfall (Fig. 9).

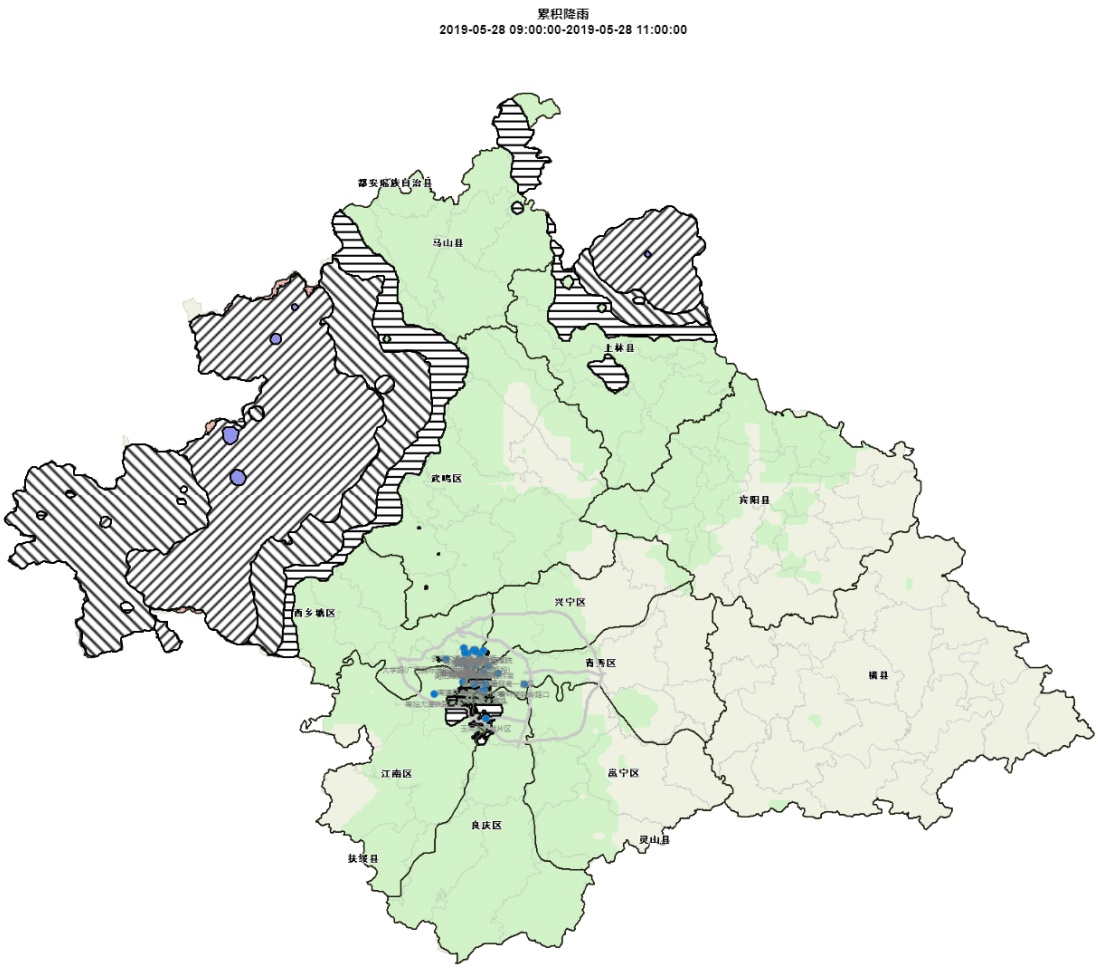



Figure 7 Rainfall in automatic rainfall station in Nanning City from 09-11 on May 28

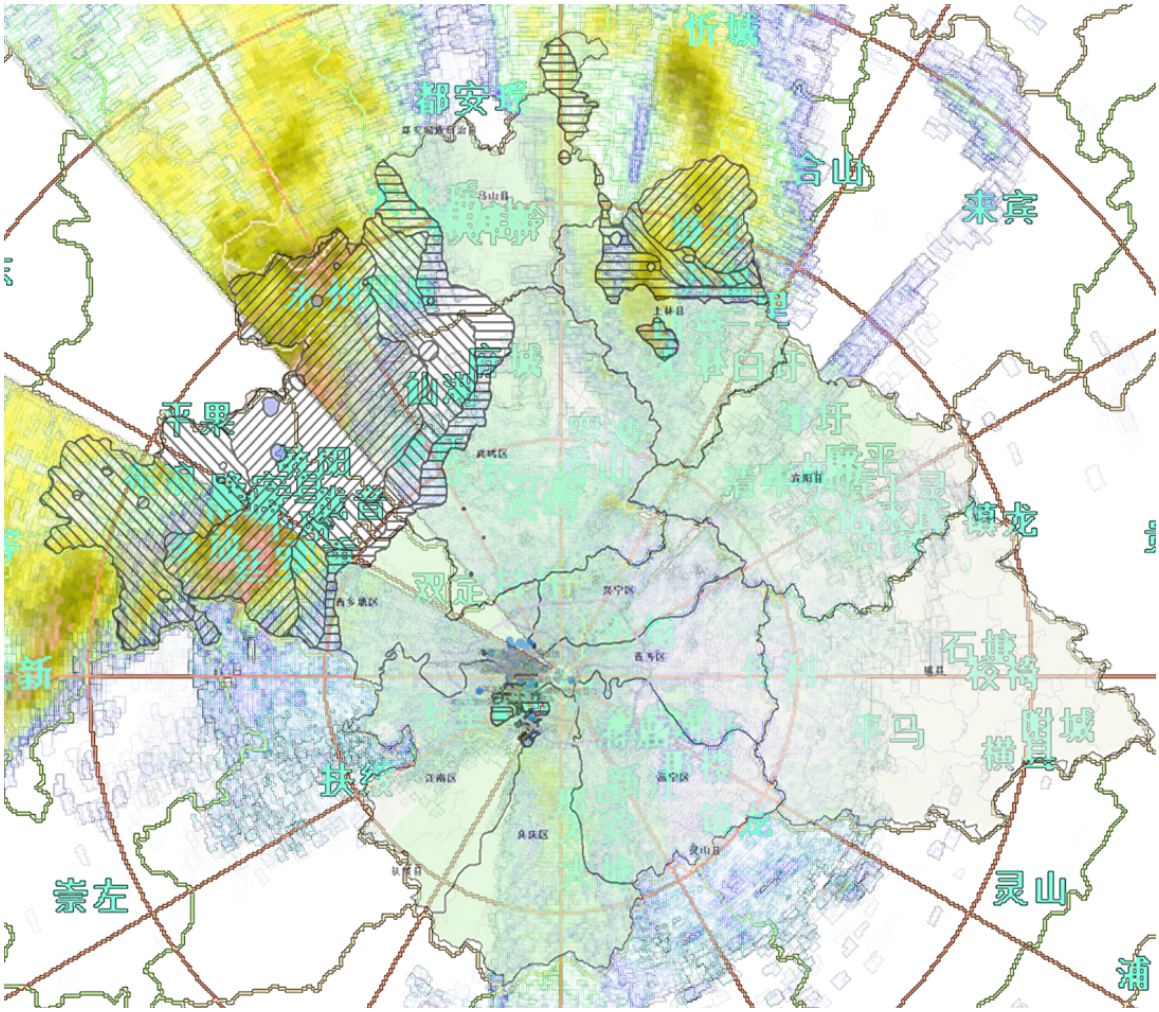



Figure 8 Comparison of automatic rainfall surface rainfall and total reflectivity

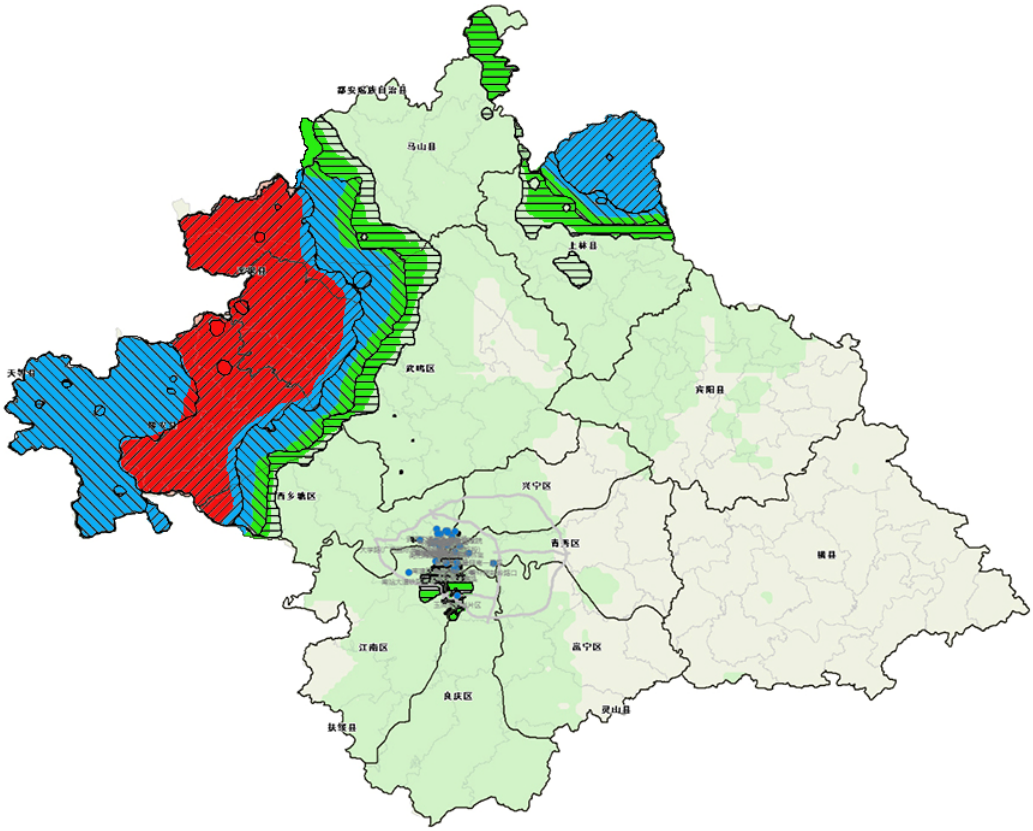



Figure 9 Comparison of Automatic Rainfall Station Surface Rainfall and Total Reflectance Surface Rainfall

## 4 Discussion

(1) When the total reflectance map is compared with the automatic rainfall station surface rainfall (Fig. 8), the total reflectivity is relatively concentrated in the southwest direction of the rainfall station surface rainfall, and the total reflectivity is added to the ground surface rainfall

after the wind field is affected (fig. 9) It is obviously covered in the northeast direction, and the coverage area is close to the rainfall area of the rainfall station.

(2) The total reflectivity obtained by different software and processing methods will give different results. In turn, it affects the accuracy of the inversion surface rainfall.

(3) Inversion of the wind field. The vad inversion is usually used to calculate the vertical profile of the horizontal average wind speed. The assumed premise is not satisfied in many cases, and it is difficult to reflect the true structure of the horizontal wind field.